The effect of Vitamin-E and In-organic Selenium on Growth Performance and Body Morphometric Traits of Japanese Quail Coturnix japonica

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Abstract

Poultry sector is playing title role in global food security issues and balanced diet with vitamins and minerals for best performance of birds is foremost requirement of this sector. Investigations were performed to evaluate the impact of Vitamin-E (Vit-E) and in-organic Selenium (in-organic Se) on growth and body morphometric traits of Japanese quail. Investigations were done on 480 birds (1-day old) of Japanese quail. The investigational birds were divided into 4 treatment sets (n=120) like (A) Vit-E @ 250mg/Kg of diet, (B) In-organic Se @ 0.2 mg/Kg of diet, (C) Vit-E+ in-organic Se, (D) control group in diet. Each group was subdivided into 6-replicates partaking 20 birds in each. Feed and water *Ad libitum* was given by automatic nipple lines drinking system. During 35-days chicks were maintained on a 24-hour light schedule. One way analysis of variance (ANOVA) and Duncan's Multiple Range (DMR) test were used for statistical analysis. Supplementation of Vit-E and in-organic Se fed diet had significant impact ($P<0.05$) on growth performance regarding feed consumption, body weight, body weight gain, food conversion ratio and livability (%). Addition of Vit-E and in-organic Se fed diet shows significant effect ($P<0.05$) on body morphometric traits regarding body length, keel length, shank length, drumstick length, drumstick diameter, chest circumference and wing spread whereas, shank diameter and wing span showed no significant effect (P>0.05). Vit-E and in-organic Se supplemented group showed remarkable influences on growth performance and body morphometric traits comparatively sole Vit-E and in-organic Se supplemented groups.

Keywords: Japanese quail, vitamin-E, in-organic Selenium, growth performance, body morphometric traits

Introduction

Japanese quail has become famous as the most targeted bird used in world of industry as well as in the areas of scientific explorations (Lima *et al*., 2023). The Japanese quail has been domesticated approximately at the 11th century as a pet song bird has gain importance as a food bird in food industry (Kismiati et al., 2023) as it has significancy in protein food security (Abdulkadir and Reddy, 2023). These birds have marvelous features such as speedy development, and greater productivity and need small areas for production at large-scale (Sabow, 2020). Japanese quail which are famous as the common name of "betair" in Pakistan. It has small incubation period of just only 17 days and quick growth is feature favoring its use in scientific research (Lukanov *et al.*, 2019). The weight of an adult bird is generally 200 g (Kismiati et al., 2023)). It holds 2 °C high temperature as compared to other poultry birds and subsequently has an amazingly high metabolism in body systems (Lima *et al*., 2023). Among different sections of poultry subdivisions, the Japanese quail has good quality properties like early maturity, small incubations period, rapid growth rates, higher eggs production, defending system against diseases, palatable meat taste (Quaresma *et al*., 2022), high production cost, connected to small next generation time gap (Mnisi *et al*., 2021). The popular species of quails is Japanese quail by using its commercial innovativeness (Azhar *et al.*, 2018).

Minerals and vitamins are considered very vital nutrients for physiological and metabolic course of development in living animals. Expert poultry manufacture is constructed on the feed of appropriate balance feed (Abdel-Fattah, 2014).

Vitamin supplementation is added to poultry feed to increase viability, decrease stresses, and improve antioxidant and growth performance parameters (Surai, 2020). Vit-E has ability to modulate reproductive well-being of farm animal by accomplishing its antioxidant role (Gao *et al*., 2023). During the initial finding of Vit-E supplementation, many researchers have verified the dietary significance of Vit-E in humans, in laboratory and poultry farming birds (Pirgozliev *et al*., 2020). The supplementation of Vit-E added in quail diets during rearing has a positive impact on the quality of meat and carcass characteristic (Pitargue *et al*., 2019).

In-organic Se as an indispensable trace element, which has fame of performing a key part in the development of reproductive performance and as well as in animal safety (Nemati & Ahmadian, 2020). In-organic Se is a vital micro-nutrient essential for normal development and maintenance in the poultry industry (Mikulková *et al*. 2019). The use of in-organic Se in quail the diet also improves immunological function and the ability of the immune system to fight against diseases (Shojadoost *et al*., 2019).

The mixture of Vit-E and in-organic Se supplement is considered to be a natural antioxidant (Konieczka *et al.*, 2015) which is extensively used in the poultry industry (Hogan *et al.*, 2013). Vit-E and in-organic Se show influence on growth performance, qualitative features, body defense system and blood metabolites of Japanese quails as well (Nemati & Ahmadian, 2020).

Poultry industry is increasing day by day due its key role for elimination of food related issues around the globe. Quail birds are in high rating of production as they are famous for palatable and nutritious meat, hence these marvelous birds are like a step of food security in ladder of world hunger problems. Minerals and vitamins take part in the growth performance of the animals and their reproductive performances significantly. Experimental evidences indicate that Vit-E and in-organic Se are vital nutrients in diet for poultry like Japanese quail as well. The foremost objective of this research work was to explain Vit-E as well as in-organic Se as significant ingredients in a balanced diet for poultry like Japanese quail and to evaluate the beneficial effects of dietary Vit-E along with in-organic Se supplementation on growth performance and body morphometric traits of Japanese quail.

Material and methods

Experimental site and design

The present investigations were performed at Avian Research and Training (ART) Center, University of Veterinary and Animal Sciences (UVAS), Lahore to explain the impact of Vit-E and Inorganic Se on growth performance as well as body morphometric features of Japanese quail. The experimental work was done on 480 birds of (1-day old) Japanese quail. These experimental birds were divided into 4 treatment groups (n=120) like (A) Vit-E @ 250mg/Kg of diet, (B) Inorganic Se @ 0.2 mg/Kg of diet, (C) Vit-E+ in-organic Se mixed, (D) control group in diet. Each group was further subdivided into 6-replicates, having 20 birds in each replicate.

Bird's husbandry

Experimental birds were positioned in an octangular breeding shed measuring 3.65×3.96×9.14meter height, width and length, accordingly. Battery cage system of French design have five-tiered placing cages including sloping wire to make easy eggs collecting were positioned in the house. To eliminate fecal stuff, conveyer belt system was fixed. The temperature of the experimental birds was kept under 33^{o}C-34^{o}C of the 1st week, and then from 2nd to 5th week temperature was kept 25^{o}C. Birds were provided fed and water *Ad libitum* in trough feeders by automatic nipples lines drinking system. During the 35-day experimental period the chicks were maintained on a 24 hours constant light schedule.

The commercial broiler starter and grower diet was provided to experimental birds. During first 10 days, starter diet was offered and in later life grower ration was given. The supplementation of Vit-E and in-organic Se was mixed with feed during feed manufacturing process at the feed mil. The supplementation would be added on the basis of basic nutritional profile of starter and grower diets. The expected feed formulation depends upon the availability of feed ingredients as indicated in (Table 1).

Table.1 Feed ingredients and chemical compositions of experimental basal diets

Ingredients names	Starter amount %	Grower amount %
Broken rice	10.000	5.000
Corn	43.906	48.823
Guar Meal	2.000	3.000

Raw rice bran	4.000	1.6
Soybean meal 42 %	16.197	4.3
Sunflower meal	7.682	12.000
Rape seed	6.000	5.000
Fish meal 44%	3.000	4.1
DL-Methionine	0.208	0.112
L-Threonine	0.069	0.028
Monodicalciumphosphate21	0.1872	—
Calcium carbonate	0.854	0.819
Salt	0.131	0.132
Lysine Suphate	0.455	0.513
Premix	0.3	0.3
Corn Gluten Meal	1.000	2.000
Bicarb	0.189	0.186
Poultry Fat	0.8	—
Feather Meal UM-54	3.000	2.000
-Quantum 1000FTU	0.02	0.02
Canola Meal	—	10.000
Cibenza Dp100-sta	—	0.05
Hemicell	—	0.03
Total	100	100

Parameter studied

Data was collected related to growth performance like feed intake, body weight (BW), body weight gain (BWG), food consumption ratio (FCR) and livability percentage (%) which was for 5 weeks on weekly basis; however, body morphometric traits like body length (BL), keel length (KL), shank length (SL), shank diameter (SD), drumstick length (DL), drumstick diameter (DD), chest circumference (CC), wing span and wing spread were recorded on weekly basis for 5 weeks.

Statistical Analysis

Data was evaluated by One way ANOVA (Steel *et al.*, 1997) in which PROC GLM is used with SAS software. The data percentage was expressed as mean ± SE. A probability value at $P < 0.05$ was measured notable. Comparison of Means was performed by Duncan's Multiple Range (DMR) test (Duncan, 1955) assuming subsequent mathematical model:

Results

Growth performance

Table 2 elaborates the effects of in-organic Se, Vit-E, control as well as those fed with Vit-E+ in-organic Se fed diet groups of Japanese quail on feed intake, BW, BWG, FCR and livability (%). A prominent difference ($P<0.05$) was shown in the average feed intake of quail during the 4^{th}, 5^{th} weeks and cumulative feed intake. The findings of the present study showed that combination of Vit-E+ in-organic Se supplemented group decreased the feed intake in Japanese quail as compared to sole Vit-E and in-organic Se supplied groups and control group respectively

A remarkable difference ($P<0.05$) was noted in the average BW of quail during the 3^{rd}, 4^{th} and 5^{th} weeks. The results of the present study indicate that combination of Vit-E+Se supplemented group improved the BW that was noted in Japanese quail as compared to sole Vit-E and Se supplemented groups and control group respectively.

A considerable difference ($P<0.05$) in the average BWG of quail was observed during the 2^{nd}, 3^{rd} weeks and cumulative BWG. The results of BWG showed that grouping of Vit-E+Se supplemented group increased the BWG observed in Japanese quail as compared to sole Vit-E and Se supplemented groups respectively.

A notable difference ($P<0.05$) in the average FCR of quail was evaluated during the 3^{rd} week and cumulative FCR. The results of FCR revealed that combination of Vit-E+Se supplemented group improved the value of FCR observed in Japanese quail as compared to sole Vit-E and Se supplemented groups and control group respectively.

A prominent difference ($P<0.05$) in the average livability (%) in quail was recorded in the cumulative livability (%). Results notified that combination of Vit-E+Se supplemented group enhanced the livability (%) in Japanese quail as compared to sole in-organic Se and Vit-E supplemented groups and control group respectively.

Body morphometric traits

Table 3 show the impacts of in-organic Se, Vit-E, control as well as those fed with Vit-E plus in-organic Se fed diet provided groups of Japanese quail on BL, KL, SL, SD, DL, DD, CC, wing spread and wing span.

A notable difference (P<0.05) in the BL of quail was recorded during the 1^{st} and 2^{nd} weeks. The results of BL showed that sole Vit-E supplemented group increased the BL in Japanese quail as compared to combination of Vit-E+Se group and sole Se group respectively.

A remarkable difference (P<0.05) in the KL of quail was observed during the 1^{st}, 2^{nd}, 4^{th} and 5^{th} weeks. The results of KL explained that combination of Vit-E+Se supplemented group elevated the KL in Japanese quail as compared to sole Vit-E group, in-organic Se group and control group.

A considerable difference (P<0.05) which was noted in the SL of quail during the 5^{th} week. The results of SL showed that combined Vit-E+Se supplemented group increased the SL in Japanese quail as compared to sole Vit-E group, in-organic Se group as well as to control group.

A non significant difference (P>0.05) was elaborated in the SD of quail during the 1^{st}, 2^{nd}, 3^{rd}, 4^{th} and 5^{th} weeks.

A considerable difference (P<0.05) was shown in the DL of quail during the 2^{nd}, 3^{rd} and 5^{th} weeks. The results of DL explained that combined Vit-E+Se supplemented and sole in-organic Se supplemented group increased the DL in Japanese quail as compared to sole Vit-E and control group.

A significant difference (P<0.05) in the DD of quail was observed during the1^{st}, 2^{nd}, 3^{rd}, 4^{th} and 5^{th} weeks. The results of the DD showed that sole Vit-E supplemented as well as sole Se supplemented group elevated the DD in Japanese quail as compared to combined Vit-E+Se and control group respectively.

Table.2 Feed intake, BW, BWG (g/bird), FCR and livability % of Japanese quail fed diets supplemented with Vit-E and in-organic Se.

Treatment groups	Day-0	Week 1	Week 2	Week 3	Week 4	Week 5	cumulative
Mean feed intake (g)							
Control		35.36±1.26	110.94±1.24	131.09±2.15	143.89±2.12^{a}	163.89±2.12^{a}	585.16±3.85^{a}
Vit-E		33.95±1.41	112.17±0.95	127.94±2.34	139.31±1.40^{ab}	159.31±1.40^{ab}	572.68±3.65^{ab}
Se		34.42±1.46	114.17±1.74	130.68±1.78	142.58±2.68^{a}	162.58±2.68^{a}	584.42±6.41^{a}
Vit-E+Se		33.83±1.08	113.47±2.75	128.21±1.33	132.08±3.63^{b}	152.74±4.13^{b}	560.33±5.96^{b}
Mean body weight (g)							
Control	7.55±0.07	21.57±0.53	58.86±1.17	102.35±2.12^{b}	151.92±2.42^{b}	196.66±2.02^{c}	
Vit-E	7.45±0.07	21.67±0.53	56.86±1.17	100.56±1.98^{b}	149.34±2.51^{b}	205.66±2.02^{b}	
Se	7.50±0.08	21.29±0.51	59.10±1.15	98.56±1.98^{b}	145.99±2.43^{b}	203.92±2.54^{bc}	
Vit-E+Se	7.52±0.11	21.94±0.45^{a}	59.30±1.04	111.34±1.87^{a}	160.03±2.97^{a}	223.34±3.42^{ab}	
Mean body weight gain (g)							
Control		14.03±0.59	37.29±0.64^{a}	43.49±0.94^{b}	49.57±0.89	44.74±4.13	189.11±1.96^{b}
Vit-E		14.22±0.51	35.19±0.64^{b}	43.69±2.82^{b}	48.79±1.37	50.22±1.71	192.11±2.43^{b}
Se		13.79±0.50	37.81±0.64^{a}	39.45±0.92^{b}	47.43±0.85	50.18±1.72	188.66±2.07^{b}

Vit-E+Se		14.42±0.41	37.37±0.59^{a}	52.04±0.83^{a}	48.69±1.72	47.75±1.09	200.26±3.72^{a}
Mean FCR g feed/ g BWG							
Control		2.55±0.16	2.98±0.07	3.02±0.06^{a}	2.91±0.08	3.82±0.34	3.05±0.04^{a}
Vit-E		2.41±0.17	3.19±0.07	2.99±0.20^{a}	2.87±0.09	3.19±0.10	2.93±0.05^{a}
Se		2.51±0.12	3.03±0.09	3.32±0.07^{a}	3.01±0.04	3.27±0.15	3.03±0.05^{a}
Vit-E+Se		2.35±0.06	3.04±0.09	2.47±0.03^{b}	2.73±0.11	3.20±0.08	2.76±0.04^{b}
Mean livability (%)							
Control		91.67±1.67	94.59±1.98	97.16±1.28	92.26±2.17	92.14±1.14	77.50±1.71^{b}
Vit-E		95.83±2.01	92.41±3.34	98.08±1.22	95.83±2.08	98.20±1.14	85.00±2.24^{a}
Se		97.50±1.12	96.62±1.68	95.52±1.63	98.04±1.24	96.37±2.31	86.67±2.79^{a}
Vit-E+Se		97.50±1.71	96.67±1.05	98.25±1.11	92.64±1.86	96.39±2.28	89.17±2.39^{a}

A remarkable difference ($P<0.05$) in the CC of quail was observed throughout the 2^{nd} and 5^{th} weeks. The results of the CC explained that combined Vit-E+Se supplemented as well as sole Vit-E supplemented group elevated the CC in Japanese quail as compared to sole in-organic Se and control group.

A notable difference ($P<0.05$) in the wing spread of quail was observed throughout the 4^{th} week. The results of the wing spread showed that sole Vit-E supplemented group increased the wing spread in Japanese quail as compared to sole in-organic Se supplemented group, combined Vit-E+Se supplemented group and control group respectively.

Table.3 Effects of fed diet supplemented with Vit-E and in-organic selenium on BL, KL, SL, SD, DL, DD, CC, wing spread and wing span (cm) of Japanese quail

Treatment groups	Day- 0	Week 1	Week 2	Week 3	Week 4	Week 5
Body length (cm)						
Control	11.96±0.45	16.50±0.22^{b}	21.90±0.18^{a}	26.94±0.44	28.64±0.14	30.32±0.30
Vit-E	11.49±0.33	17.50±0.22^{a}	21.08±0.20^{ab}	27.54±0.20	28.74±0.56	30.38±0.24
Se	11.55±0.36	17.33±0.33^{a}	20.78±0.44^{b}	27.28±0.48	29.90±0.11	29.82±0.14
Vit-E+Se	11.80±0.34	17.33±0.21^{a}	21.08±0.16^{ab}	27.83±0.16	28.80±0.38	30.28±0.21
Keel length (cm)						
Control	0.70±0.01^{ab}	0.90±0.03^{b}	2.50±0.07^{b}	3.12±0.07	3.78±0.09^{a}	4.22±0.05^{ab}
Vit-E	0.70±0.01^{b}	0.98±0.04^{b}	2.95±0.08^{a}	3.38±0.10	3.24±0.06^{b}	4.10±0.04^{b}
Se	0.69±0.01^{b}	0.92±0.03^{b}	2.56±0.09^{b}	3.18±0.07	3.56±0.09^{a}	4.32±0.05^{a}
Vit-E+Se	0.74±0.02^{a}	1.25±0.14^{a}	2.62±0.05^{b}	3.20±0.03	3.66±0.16^{a}	4.36±0.03^{a}
Shank length (cm)						
Control	0.59±0.01	0.88±0.03	2.44±0.10	3.02±0.06	3.20±0.09	3.83±0.05^{bc}
Vit-E	0.60±0.01	1.05±0.16	2.51±0.07	2.98±0.08	3.32±0.09	3.75±0.03^{c}
Se	0.60±0.01	0.86±0.02	2.60±0.09	3.02±0.03	3.14±0.08	3.91±0.04^{ab}
Vit-E+Se	0.58±0.02	1.12±0.10	2.66±0.06	3.04±0.06	3.14±0.10	3.97±0.03^{a}
Shank diameter (cm)						
Control	0.38±0.05	1.11±0.03	1.40±0.04	1.46±0.07	1.48±0.05	1.58±0.05
Vit-E	0.33±0.03	1.15±0.04	1.49±0.07	1.62±0.02	1.58±0.09	1.68±0.05
Se	0.43±0.05	1.30±0.14	1.32±0.07	1.50±0.06	1.44±0.04	1.66±0.02
Vit-E+Se	0.37±0.04	1.01±0.07	1.36±0.04	1.44±0.08	1.48±0.06	1.62±0.03
Drumstick length (cm)						

Control	0.79±0.03	1.06±0.04	4.20±0.10^{b}	5.04±0.10^{b}	5.94±0.13	6.28±0.06^{a}
Vit-E	0.89±0.09	1.06±0.02	4.95±0.13^{a}	5.56±0.06^{a}	5.70±0.17	5.64±0.18^{b}
Se	0.80±0.02	1.06±0.03	4.30±0.20^{b}	5.22±0.03^{b}	6.18±0.03	6.30±0.06^{a}
Vit-E+Se	0.80±0.01	1.01±0.12	4.24±0.04^{b}	5.14±0.07^{b}	5.96±0.14	6.34±0.04^{a}
Drumstick diameter (cm)						
Control	0.92±0.04	1.32±0.13^{c}	3.00±0.13^{b}	3.50±0.09^{b}	4.36±0.05^{b}	4.12±0.08^{b}
Vit-E	1.05±0.04	1.83±0.03^{ab}	3.63±0.07^{a}	4.20±0.08^{a}	4.80±0.07^{a}	4.50±0.13^{a}
Se	1.01±0.05	1.53±0.09^{bc}	3.02±0.05^{b}	3.78±0.09^{b}	4.54±0.08^{b}	4.66±0.11^{a}
Vit-E+Se	1.04±0.05	1.88±0.13^{a}	2.76±0.07^{b}	3.63±0.15^{b}	4.36±0.04^{b}	4.44±0.04^{a}
Chest circumference (cm)						
Control	1.81±0.10	4.16±0.23	7.92±0.24^{b}	10.42±0.27	12.62±0.14	13.96±0.14^{bc}
Vit-E	1.79±0.14	4.30±0.17	9.31±0.16^{a}	11.00±0.15	13.06±0.39	14.51±0.21^{ab}
Se	1.70±0.09	3.74±0.15	7.92±0.23^{b}	10.90±0.08	12.98±0.24	13.62±0.13^{c}
Vit-E+Se	1.82±0.12	4.41±0.34	8.42±0.08^{b}	10.91±0.10	13.53±0.40	15.13±0.37^{a}
Wing spread (cm)						
Control	2.35±0.17	5.38±0.21	12.66±0.37	14.62±0.26	16.04±0.20^{ab}	16.82±0.22
Vit-E	2.12±0.19	5.28±0.23	13.13±0.43	15.30±0.09	15.54±0.17^{b}	17.18±0.31
Se	2.18±0.12	5.41±0.23	12.50±0.20	15.06±0.26	16.32±0.11^{a}	17.20±0.06
Vit-E+Se	2.02±0.15	5.56±0.19	12.44±0.04	14.63±0.10	16.56±0.27^{a}	16.98±0.15
Wing span (cm)						
Control	3.15±0.04^{ab}	8.50±0.22	27.28±0.67	33.18±0.31	35.60±0.35	37.74±0.35

Vit-E	2.82±0.15[b]	8.72±0.22	28.04±0.50	33.70±0.21	35.96±0.39	38.46±0.31
Se	2.95±0.18[b]	8.92±0.23	26.26±0.33	34.02±0.22	35.58±0.42	38.00±0.19
Vit-E+Se	3.43±0.11[a]	9.10±0.19	27.02±0.06	33.53±0.10	35.92±0.51	37.72±0.22

Discussion

Our results of the present-day study disclosed that Vit-E and in-organic Se supplementation positive influence on feed intake. It might be due to improved physiology that made the birds feeling less appetite. In agreement with our study, Mobaraki and Aghdam, (2015) who recorded that Vit-E and in-organic Se can decrease feed intake in Japanese quail. However, contradictory findings were reported by Adamnezhad and Ghalehkandi, (2018) the supplementation of feed consisting of several levels of Vit-E (150 and 300 mg/kg) and in-organic Se (0.2 and 0.4 mg/kg) had no considerable effects on feed consumption.

We observed a significant variation ($P< 0.05$) on BW and BWG of Japanese quail. In agreement with our observation, Chitra *et al*. (2016) who recommended that addition of combined Vit-E+Se supplement in Japanese quail fed diet at different levels enhanced the BW and BWG of Japanese quail as compared to sole Vit-E, sole in-organic Se and un-supplemented groups. Moreover, Zia *et al.* (2017) also suggested that inorganic Se 0.25-1.0 mg/kg and Vit-E at the dose of 200 IU/kg have incredibly enhanced BW and BWG in broiler. Still, contradictory findings were reported by Adamnezhad and Ghalehkandi, (2018) that the supplementation of diet consisting of varied levels of Vit-E (150 and 300 mg/kg) and in-organic Se (0.2 and 0.4 mg/kg) had no prominent effects on BW and BWG as compared to control treatment in Japanese quail. Similarly, Safakhah *et al.* (2019) studied that, the used of Vit-E 150 mg/kg and Se 0.2 mg/kg do not influence on the BW and BWG of Japanese quail.

We found a noteworthy change in the FCR in supplemented group as examined parallelly to control group. Our results were in accordance with Mobaraki and Shahrya, (2015) recorded that Vit-E and in-organic Se (160 mg/kg Vit-E + 0.4 mg/kg Se) can decrease FCR value in laying Japanese quail. Though, contradictory findings were reported by Zia *et al,* (2017) suggested that in-organic Se 0.25-1.0 mg/kg and Vit-E at the dose of 200 IU/kg resulted in remarkably poor FCR in broiler.

Our results of livability (%) is accordance with Dalia *et al.* (2017) who evaluated that used of overload nutritional Vit-E and in-organic Se for increasing the immunity struggle and suppressed the diseases resulting livability percentage increase. Similarly, Habibian *et al.* (2014) concluded that collective supplementary levels of Vit-E and in-organic Se (250 mg/kg Vit-E and 0.5 mg/kg Se) may be essential for enhanced immunity and health of Japanese quail. The Vit-E+Se supplement combination was more influencing antioxidants as associated to sole Vit-E and in-organic Se supplementation.

We explored a remarkable change (P< 0.05) in Japanese quail BL, KL and SL in supplemented group as well as in comparison with control group. In agreement with our observation, Behiry, (2019) revealed that Vit-E and Se supplementation was found to enhance the BL, KL and SL in White Kołuda geese. The higher BL, KL and SL in Vit-E and in-organic Se supplemented group as compared to control group, might be with the reason of higher body weight since a strong correlation between BL, KL, SL and BW of birds were recorded by Akram *et al.* (2013).

We observed a non-significant variation (P> 0.05) in Japanese quail SD and wing span in fed diet supplemented group. Finding of the SD and wing span is similar to that of Bhuiyan *et al.* (2019) stated that supplementation with Vit-E 250 mg +0.3 mg of in-organic Se showing non-significant differences among treatment groups of SD and wing span measurement of Japanese quail. Zia *et al.* (2017) who reported that, sodium selenite 0.3 mg/kg showed non-significant effect on wing span of broiler chicken.

We observed a significant change (P<0.05) in Japanese quail DL, DD, CC and wing spread in supplemented group as well as in comparison with control group. In agreement with our findings, Bhuiyan *et al*. (2019) stated that supplementation with Vit-E 250 mg +0.3 mg of Se might improving their growth performance and showing significant effects of body morphometric traits such as DL, DD, CC and wing spread. Similarly, Behiry, (2019) reported the impact of Vit-E and in-organic Se supplementation to enhance the DL and DD in White Kołuda geese. In addition, Nosike *et al.* (2018) manipulated that, growing KL or CC through assortment was consequence in parallel enhancement in BW. It might be with the reason of combined Vit-E plus in-organic Se supplementation showing more significant effects on growth performance and live BW of Japanese quail.

Conclusion

Findings of above results gives this concluding point that the supplementation of Vit-E and along with in-organic Se fed diet during rearing had significant effect on growth performance of Japanese quail regarding feed intake, BW, BWG, FCR and livability %. Similarly, supplementation of Vit-E and in-organic Se diet during rearing had significant effect on body morphometric traits of Japanese quail regarding BL, KL, SL, DL, DD, CC and wing spread. However, SD and wing span showing no significant impact. From the obtained results, notable outcome is that the combination of Vit-E plus in-organic Se fed diet supplementation treatment group showing more beneficial positive influences on growth performance and body morphometric traits of Japanese quail as compared to sole Vit-E and sole in-organic Se fed diet supplementation treatment groups.

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